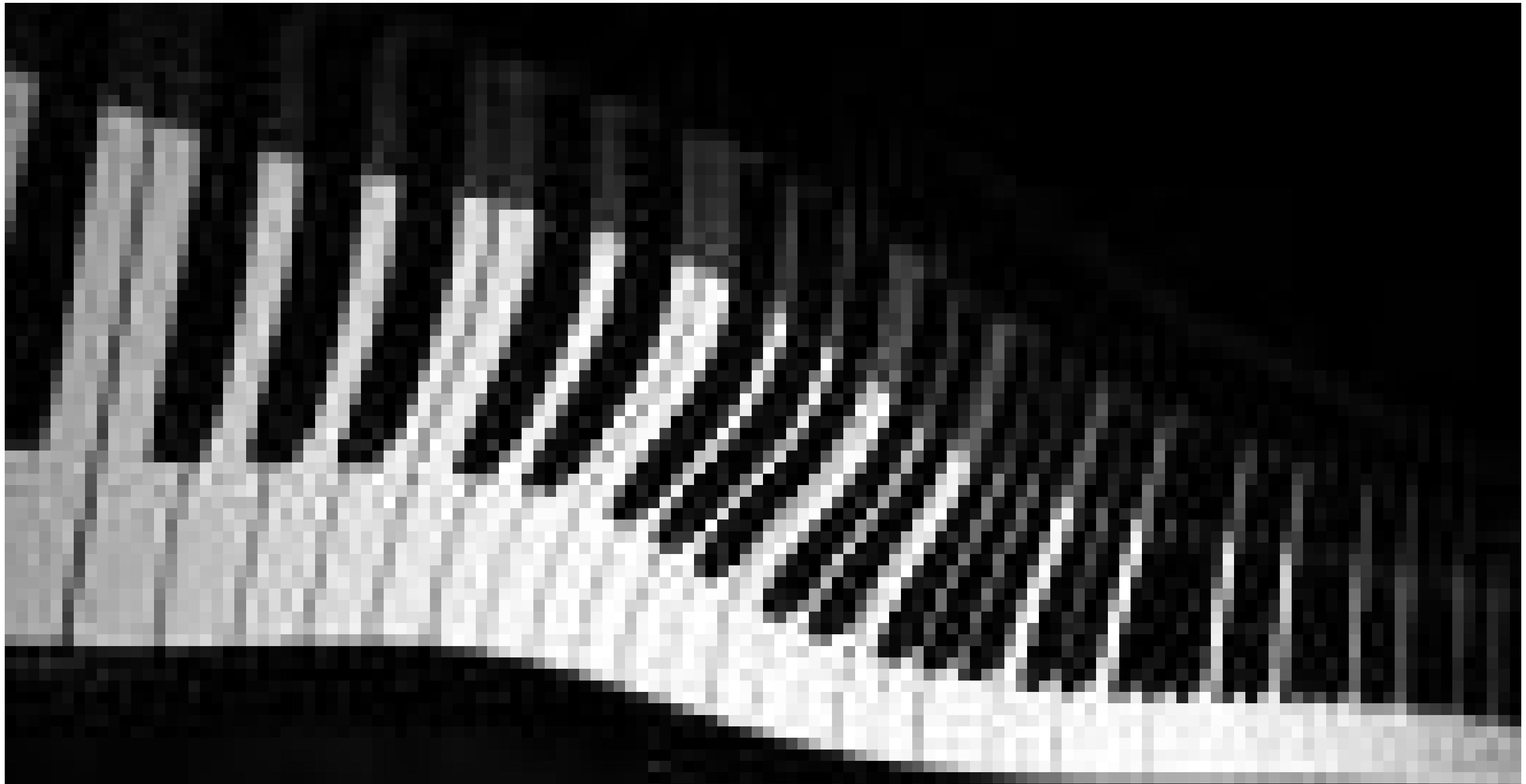
Auditory maps (sound)

What do you need from a sound map?



Topographic representation of frequency information:

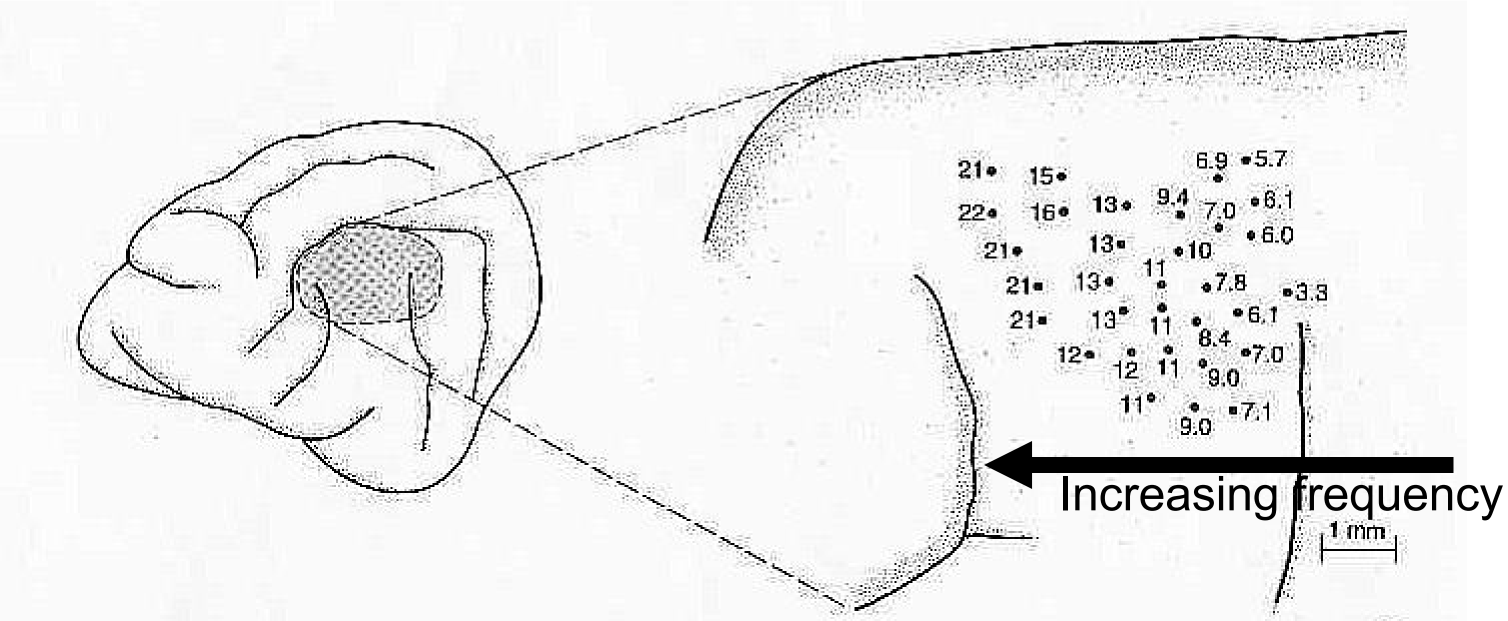


Figure 8.32
Left: The cat's brain, showing the location of the auditory receiving area (shaded). Right: A close-up of the auditory receiving area, showing the tonotopic map on the cortical surface. Each large dot represents a single neuron, and the number beside each dot represents the characteristic frequency of that neuron in thousands of Hz. (From Abeles & Goldstein, 1970, and Gulick, Gescheider, & Frisina, 1989.)

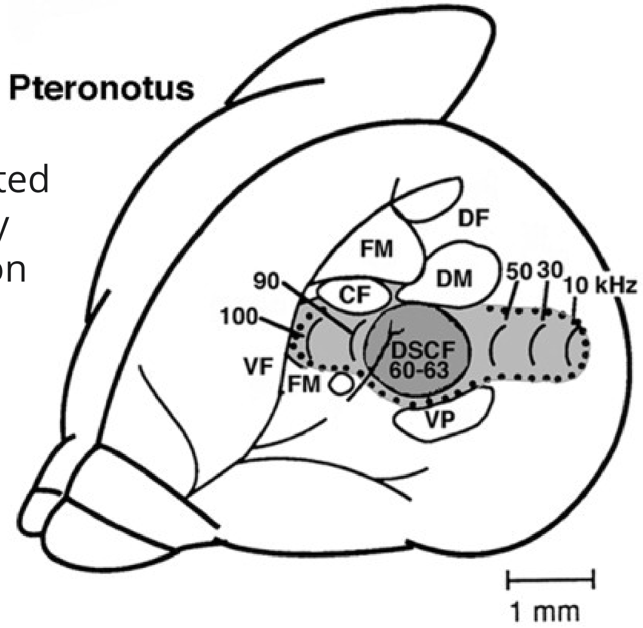
Representation of a <u>continuous</u> variable

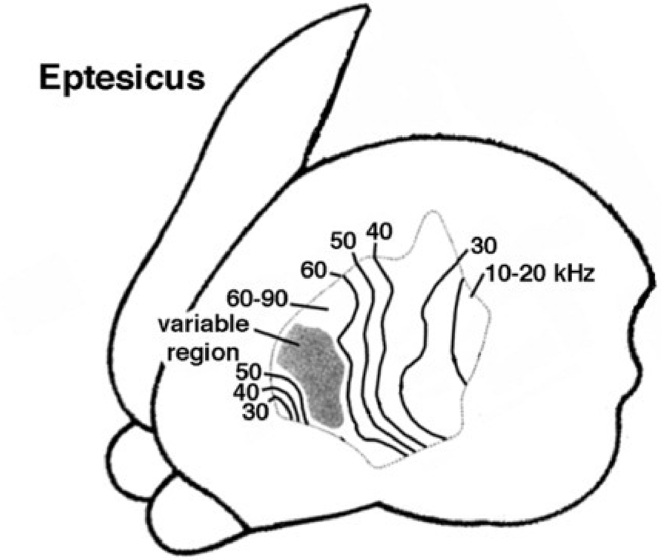
Essential information: acoustic fovea (magnification)

Encoded by same gradients as for the visual maps

Neurobiological specializations in echolocating bats

DSCF= Doppler-shifted
CF2 area or auditory
foveal representation





The mustached bat, *Pteronotus parnellii*,

- Hunts for insects in dense foliage
- Uses relatively long constant frequency calls followed by a short FM component (CF-FM)
- Allows the bat to detect flying insect prey.

The big brown bat, *Eptesicus fuscus*

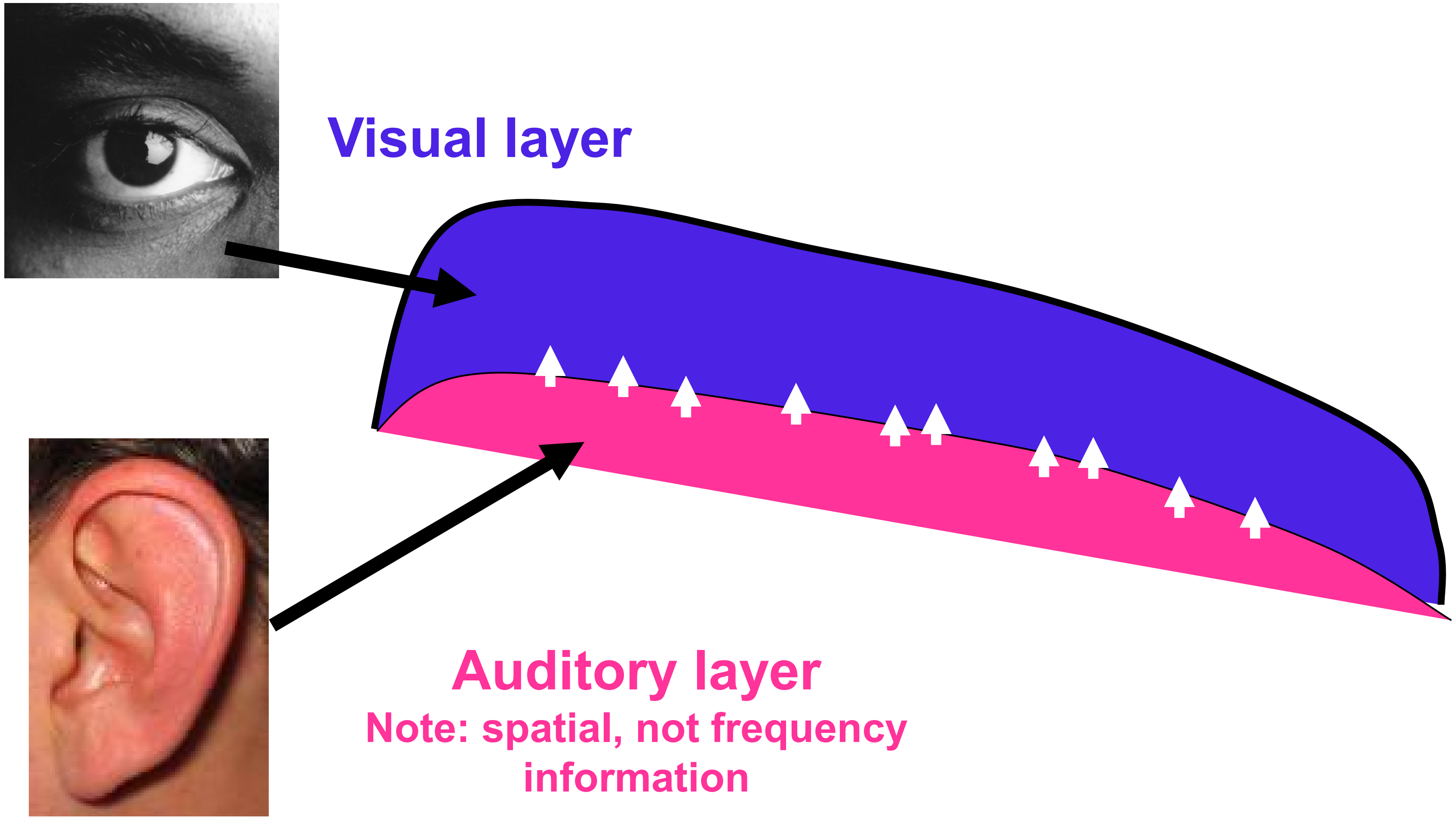
- Insectivore but hunts in more open spaces
- Diet of beetles

The Anatomical Record Part A: Discoveries in Molecular, Cellular, and Evolutionary Biology, Volume: 287A, Issue: 1, Pages: 1103-1116, DOI: (10.1002/ar.a.20254)

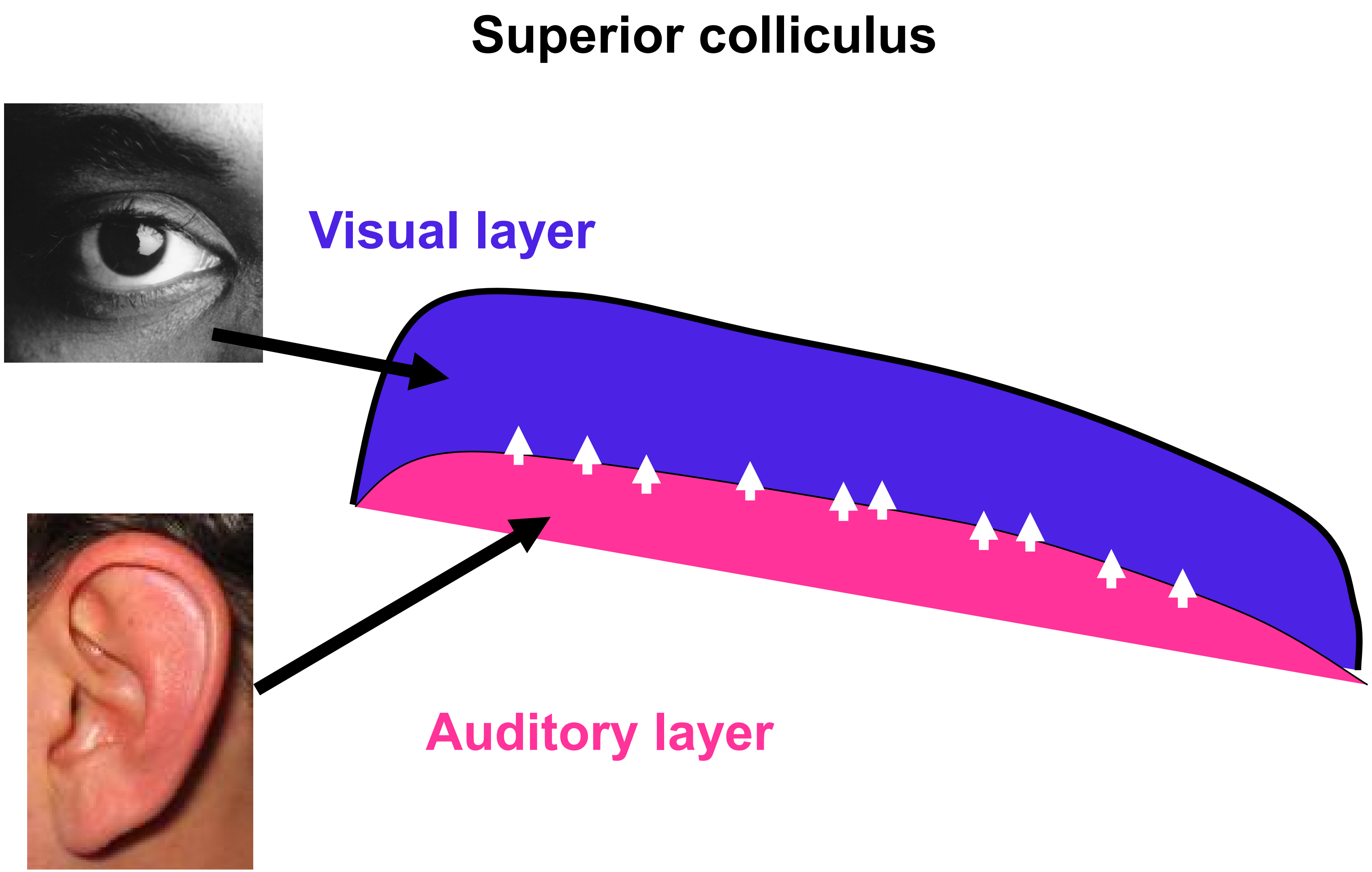
Integration of vision and hearing

Integration of vision and hearing

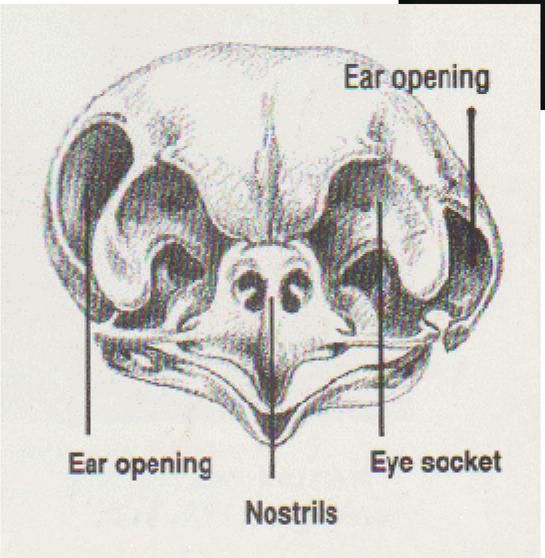
Superior colliculus



Integration of vision and hearing



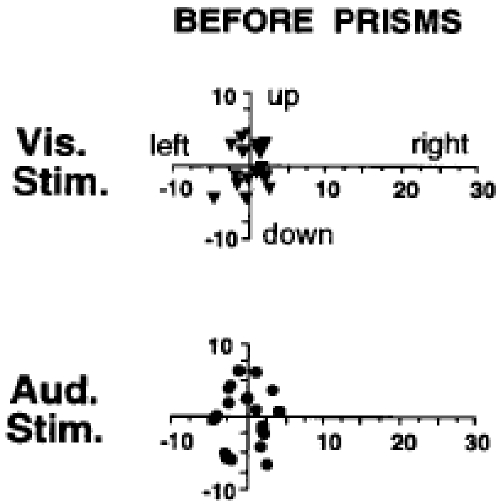
Owls integrate auditory and visual information to capture prey



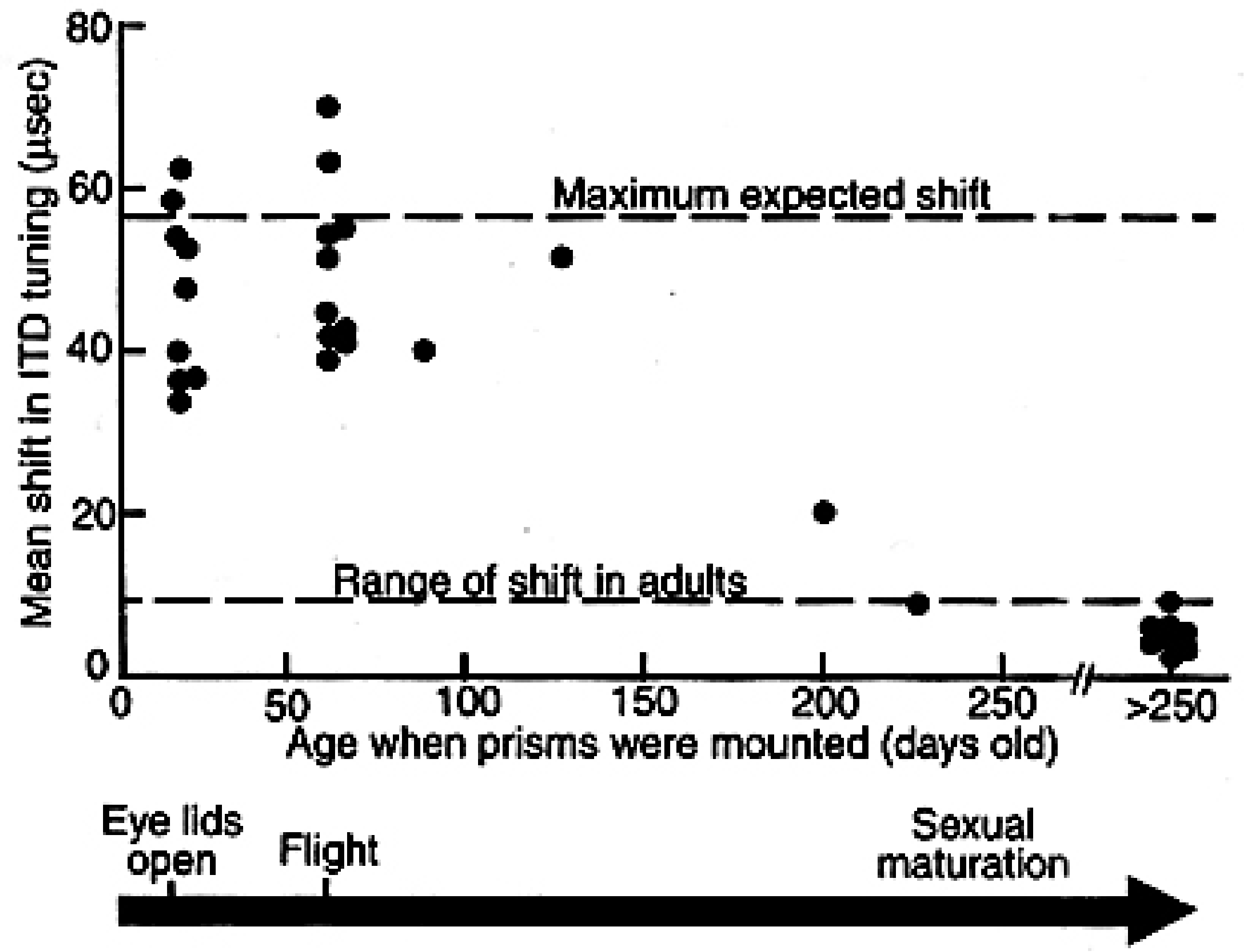
Forward-facing eyes and ears

Integration of vision and hearing

Head orienting to visual or auditory stimuli



When can auditory connections shift?



Key concepts: Visual and auditory integration

- Acoustic fovea
- Visual map forms normally even in the dark.
- Auditory map forms based on visual map (i.e. does not form in the dark)
- Animal needs light to be able to localise sound